TITLE OF THE INVENTION

THROTTLE SENSOR

FIELD OF THE INVENTION

The present invention relates to a sensor for detecting the rotational angle of a rotary shaft, and more particularly to the structure of a throttle sensor for detecting the rotational angle of the throttle valve spindle of an internal combustion engine.

BACKGROUND OF THE INVENTION

As a prior art throttle sensor, there has been proposed one wherein, as disclosed in Japanese Utility Model Publication No. 99109/1982 published on June 18, 1982 entitled "Throttle open degree detector", a sensor element is of the stand-alone type, and the sensor element including a bearing is mounted on a throttle body, thereby to detect the rotational angle of a throttle valve spindle.

The prior art throttle sensor has been structurally such that, since the sensor element and the throttle body are separated each other, the former has the bearing portion, a joint etc. Therefore, the structure of the sensor element has become complicated causing such problems as a large size and a high cost.

SUMMARY OF THE INVENTION

An object of the present invention is to provide a throttle sensor of small size in which a sensor element does not have a bearing portion and a joint.

In order to accomplish the above object, brushes are mounted on a throttle valve spindle through a holder, a ceramics circuit board which has resistors adapted to come into sliding contact with the brushes is comprised at a position opposing to the brushes, the resistors serving to generate a continuous electric signal in accordance with the rotational angle of the throttle valve spindle, and a housing which holds the ceramics circuit board and which is unitary formed with a lead frame and a connector is detachably fixed to a throttle body.

Moreover, in consideration of the easy assemblage of a sensor element and the holding of the contact pressure between the brushes and the resistors, the brushes are arranged on the outer side of the holder, or the side thereof remote from the throttle body, and the distance between the holder and the resistors is kept constant within a recess of a throttle body.

With the throttle sensor of the present invention, the brushes are mounted on the throttle valve spindle through the holder. Therefore, the sensor element can do away with bearings for receiving the throttle valve spindle and the joint, and the number of components is reduced, thereby to simplify the structure of the sensor element of the throttle sensor.

Besides, the brushes are arranged on the outer side of the holder, or the side thereof remote from the throttle body. This leads to the easiness of the mounting of the housing, and the easiness of the holding of the contact pressure between the brushes and the resistors.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 illustrates a view of the whole construction showing the present invention;

Fig. 2 is a detailed view of a holder and brushes;

Fig. 3 is a view of resistor patterns;

Fig. 4 is a view of the mounting of a housing;

Fig. 5 is a view for explaining the contact method of the brushes and resistors; and

Fig. 6 is a developed plan of the resistors shown in Fig. 3.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring to Fig. 1, numeral 1 designates a throttle body, and a throttle valve 2 is fixed to a throttle valve spindle 3 by screws 4 for fixation. In addition, the throttle ~~vale~~ valve spindle 3 is rotated in accordance with the tread of an accelerator pedal (not shown), and it is mounted on the throttle body 1 through bearings 5. Numeral 6 designates a holder which is made of a resin or the like, and which is fixed to one end of the throttle

valve spindle 3 by press fitting or the like. Numeral 7 indicates a brush which is joined to the holder 6. The brushes 7 slide on resistors 9 shown in Fig. 3 which are arranged on a ceramics circuit board 8 and which are made of electrically conductive plastics, with the rotation of the throttle valve spindle 3. On this occasion, assuming that the side of the throttle body 1 as viewed from the holder 6 having the brushes 7 is the inner side with respect to the holder 6, the brushes 7 are arranged on the outer side of the holder 6, or the side remote from the throttle body. Besides, the ceramics circuit board 8 is arranged orthogonal to the extending direction of the throttle valve spindle 3. Here, the resistors 9 have a power source V_{CC} in the terminal 20 and earth GND connected to the terminal 21, whereby when the brushes 7 slide on the patterns of the resistors 9, a continuous electric signal V_0 outputted from the terminal 19 is generated in accordance with the rotational angle θ of the throttle valve spindle 3, that is, with the rotations of the brushes 7. Numeral 22 denotes the support terminal for supporting the movement of the brush 7. Further, the resistors 9 are connected to a connector 11 through a lead frame 10. Thus, the electric signal V_0, power source V_{CC} and earth GND are relayed to or from the exterior of the throttle sensor through the connector 11. The ceramics circuit board 8, lead frame 10 and connector 11 are formed to be unitary with a housing 12. As shown

in Fig. 4, the housing 12 is detachably mounted on the throttle body 1 through adjustment slots 14 forming unloaded holes by the use of fitting screws 13.

Here, the contact method of the brushes 7 and the resistors 9 will be described with reference to Fig. 5. A recess is provided within the throttle body 1 at one side of the throttle valve spindle 3 along the axial direction of the throttle valve spindle 3 for accommodating the holder 6 which is fixed to one end of the throttle valve spindle 3. The brushes 7 are mounted on the holder 6 as shown in Fig. 2. The protrusion, which is provided for mounting the ceramics circuit board 8 of the housing 12, engages with the recess provided to the throttle body 1. When the protrusion of the housing 12 is engaged with the recess, the resistors 9 contact ~~to~~ the brushes 7. The resistors 9 are contacted ~~slidden~~ by the brushes 7, when the throttle valve spindle 3 rotates. Suppose that the depth of the recess is X, and the height of the protrusion is Y. When the protrusion engages with the recess, the distance Z between the holder 6 and the resistors 9 can be expressed by Z=X-Y without respect to ~~expecting~~ the thickness of the holder 6 and the protruded length of the throttle valve spindle 3 from the bottom of the recess to the closest ~~most nearest~~ surface of the holder 6 to the bottom. 15 denotes the fitting surface of the throttle body 1 to the housing 12, 16 denotes the fitting surface ~~that~~ of the housing 12 to the throttle body 1.

Hereunder, we will explain how to adjust the initial value of the rotational angle θ of the throttle valve spindle 3, namely, the minimum value of the electric signal V_0 is expressive of the rotational angle θ through the fine adjustments of the fitting position of the housing 12 and is obtained by rotating the two adjustment slots 14 around the two fitting screws 13, respectively, referring to Figs. 4, 6 and 1. When the position of the housing 12 is finely adjusted in C_1 and C_2 directions as shown in Fig. 4 on the basis of the adjustment slots 14 of the housing 12, the brushes 7 held in sliding contact with the resistors 9 moves on the resistors 7 shown in Fig. 6, whereby the voltage division ratio 17 of resistances is changed to generate the electric signal V_0. When the rotational directions C_1 and C_2 of the adjustment slots 14 shown in Fig. 4 are, for instance, clockwise, the brushes 7 shown in Fig. 6 are moved ~~upper and lower directions~~ respectively corresponding to the movement of the rotational directions C_1 and C_2, respectively. Fig. 6 shows the example in which the initial positions of the brushes 7 are on the side of the earth GND, and the minimum value or initial value of the electric signal V_0 is finely adjusted. The housing 12 and the throttle body 1 are tightly sealed by an O-ring 18.

According to the embodiment, the brushes 7 are mounted on the throttle valve spindle 3 of the throttle body 1 through the holder 6. Therefore, the throttle

sensor has the effect that the sensor element dispenses with bearings for receiving the throttle valve spindle etc., a joint, and so forth. As another effect, the arrangement of the brushes 7 on the outer side of the holder 6 on the side remote from the throttle body leads to the easiness of the mounting of the housing 12 on the throttle body 1 and the easiness of the holding of the contact pressure between the brushes 7 and the resistors 9.

Since the present invention is constructed in such a manner that the throttle body is formed uniformly together with the throttle sensor, it achieves effects as stated below. The brushes are mounted on the throttle valve spindle of the throttle body through the holder, so that bearings for receiving the throttle valve spindle etc., a joint, and so forth as a stand-along type sensor shown by the prior art mentioned before are dispensed with to simplify a sensor structure. Moreover, the arrangement of the brushes on the outer side of the holder, namely on the side remote from the throttle body, leads to the easiness of the mounting of the housing on the throttle body and the easiness of the holding of the contact pressure between the brushes and the resistors.